EPA United States Environmental Protection Agency

Office of Prevention, Pesticides, and Toxic Substances

PC Code: 032201
DP Barcode(s): D281199

March 5, 2002

MEMORANDUM

SUBJECT: Revised Tier I Drinking Water and Aquatic Ecological Exposure Assessments for Diquat Dibromide

TO: Joanne Miller/Dan Kenny, Product Manager #23
Registration Division (7505C)

Betty Shackleford/Tyler Lane, Product Manager #53
Special Review and Reregistration Division (7508C)

FROM: James Breithaupt, Agronomist
Environmental Risk Branch II/EFED (7507C)

THROUGH: Tom Bailey, Ph.D., Chief
Environmental Risk Branch II/EFED (7507C)

This memorandum contains a revised Tier I drinking water assessment for diquat dibromide for terrestrial and aquatic uses in response to Syngenta's comments on EFED's October, 2001 assessment. The February 20, 2002 letter from Syngenta correctly noted that the potable water studies were modeling efforts, not monitoring data. Therefore, EFED is recommending the use of the MCL (20 ug/L) for ground and surface water exposures from direct aquatic applications instead of Syngenta's modeling values. However, EFED is unaware of any drinking water utility being out of compliance with respect to diquat. For terrestrial uses, EFED also recommends using the FIRST modeling outputs for drinking water exposure from surface water and the MCLG (20 ug/L) for ground water. The assessed terrestrial crops include potatoes, alfalfa, and clover (preharvest) as either aerial or ground application and trees, vines, small fruits, and vegetables as a directed spray using ground equipment. The use on grain sorghum for seed production was not assessed because the area to be treated is minor. The assessed aquatic uses include application to lakes and flowing streams. For the aquatic use, EFED has included use information from the Corp of Engineers and the states of Florida, Minnesota, and Michigan. If there are any questions, please call Jim Breithaupt at (703) 305-5925.

A. GENERAL CONCLUSIONS

Diquat is persistent but essentially immobile in the environment, indicating that it will most likely be associated with the soil and sediment instead of the water column. EFED used the Generic Estimated Environmental Concentration (GENEEC2) model to estimate concentrations in surface water for ecological effects and the Food Quality Protection Act (FQPA) Index Reservoir Screening Tool model (FIRST) to estimate concentrations in surface water for drinking water. The Screening Concentration in Ground Water (SCI-GROW) model was used to estimate ground water concentrations from the terrestrial uses. However, EFED does not recommend using the results because of higher concentrations reported in the OW occurrence monitoring report (see below). The Estimated Environmental Concentrations (EEC's) from the GENEEC2 and FIRST models may be found in Tables 1 and 2, respectively. Table 3 provides the ground water concentration estimates for diquat using the Agency MCLG/MCL. The inputs, assumptions, and outputs for each model for GENEEC2, FIRST, and SCI-GROW are included in Appendices A, B, and C, respectively.

For terrestrial uses of diquat, EFED is recommending that HED incorporate concentrations from FIRST for surface water (Table 2) and the MCLG/MCL for ground water (Table 3) into the dietary risk assessment. The estimated concentrations from FIRST ranged from 6.3-13.2 for peak exposure and 0.2-0.4 ppb for chronic exposure. The SCI-GROW model estimated a concentration of 0.006 ppb. However, based on municipal monitoring data, EFED is recommending the use of the MCLG/MCL of 0.02 ppm (20 ug/L) for ground water. A publicly-released copy of this report will be provided to Syngenta in Mid-March.

EFED is also providing estimates of surface and ground water concentrations from aquatic use of diquat for the dietary risk assessment. For surface water, EFED recommends using the MCLG/MCL of 0.02 ppm (20 ug/L) to assess both acute and chronic effects based on the Office of Water compliance monitoring data (See Section B below). In addition to the available monitoring data, the registrant provided potable water studies (an extensive modeling effort) to estimate high end to upper bound drinking water exposure from surface water (MRID's 43798501 and 44492901) that is directly treated with diquat. The generally low EECs from the water modeling are consistent with the tendency of diquat to sorb nearly irreversibly to soil or sediment. While the EEC's from this modeling effort were not used in this assessment because of available monitoring data at surface water intakes, the data from the modeling effort provided times following treatments to water use and distances from treated areas to intakes to achieve diquat concentrations below the MCLG/MCL. For river systems, the maximum time of MCLG exceedence following treatment is expected to be 48 hours (4-8 hours typical). The maximum distance from a treated area required for concentrations of less than the MCLG is 1600 feet (1000-1200 feet typical). For reservoirs, the maximum time of MCLG exceedence is expected to be 4 hours. The maximum distance where the MCL is likely to be exceeded is 400 feet. For ground water exposure from the aquatic use, EFED recommends using the MCLG for acute and chronic concentration estimates based on the Office of Water compliance monitoring data. The affected population would be anyone drinking from a well that is close to treated aquatic areas. Diquat is used near these wells to control aquatic weeds instead of more mobile materials. While concentrations in excess of 20 ppb in private wells cannot be ruled out, they are unlikely because of the tendency of diquat to sorb nearly irreversibly to soil and sediment.
There are potentially exposed populations, including known populations in South Central Florida.

However, the label prescribes non-use periods during which water cannot be used, and distance restrictions from treated areas are expected to reduce diquat concentrations to below the MCLG at drinking water intakes. These time and distance restrictions are consistent with the results of potable water studies. Based on personal communication with Dan Thayer of the South Florida Water Management District, there are between 25,000 and 100,000 people who draw their drinking water from Lake Okeechobee, depending on the season. Diquat is used in the lake or in canals feeding the lake. In summer, the population is about 25,000, and in winter, about 100,000. The intakes include Clewiston, Belle Glade, Pahokee, and Okeechobee City, which is now putting in wells for reasons other than pesticides. Belle Glade has two intakes, and the one closer to the treated area is shut off for the prescribed time on the label. Also, drinking water exposure will be reduced in Florida because diquat is only used to treat small areas in or around the 700 square mile lake, thus diluting the residues.

Table 1. GENEEC2 Diquat EEC's for Ecological Risk Assessment to Aquatic Species.

	Acute (ug/L)	Chronic (ug/L)			
Crop	Peak	4-Day	21-day	60-day	90-day
Trees, vines, small fruits, vegetables	2.3	1.3	0.3	0.1	0.1
Alfalfa, Clover	1.2	0.7	0.2	0.1	0.04
Non-Crop (fallow land)	1.2	0.7	0.2	0.1	0.04
Potatoes	2.4	1.4	0.3	0.1	0.1

Table 2. FIRST Diquat EEC's for Drinking Water Assessment from Surface Water

	EEC's	
Crop	Peak (Acute)	Annual Mean (Chronic)
Trees, vines, small fruits, vegetables	13.2	0.4
Alfalfa, Clover	6.3	0.2
Non-Crop (fallow land)	6.6	0.2
Potatoes	12.7	0.4

Table 3. Ground Water EEC's for Drinking Water

Type of Use	Use Site	EEC
Terrestrial	Trees, vines, small fruits, vegetables, alfalfa, clover, non-crop (fallow land), and potatoes	20 ug/L[1] (Acute, Chronic, Cancer)
Aquatic	Ditches, reservoirs, and rivers	20 ug/L[1] (Acute, Chronic and Cancer)

[1] Agency MCL

B. ENVIRONMENTAL FATE SUMMARY AND GROUND AND SURFACE WATER SUMMARY

Environmental fate data indicate that diquat is miscible in water (7 x 10^5 ppm), is stable to hydrolysis and photolysis, and metabolism, but is essentially immobile in soil and sediment. The extent of adsorption appears to be related to soil pH, with is consistent with cation exchange in soil.

Some surface and ground water monitoring data are available for diquat. The sources of available monitoring data include the South Florida Water Management District (SFWMD), potable water studies from the registrant, and the EPA Office of Water. The SFWMD data contained a total of 42 samples that were taken from April 1992 to November 2000 on approximately a 1-3 month interval. For diquat, the only detection observed in surface water was 0.0045 ppm in 1994. Further monitoring beyond 1994 has not shown any detections in surface water. Also in the SFWMD, diquat was detected in 9 sediment samples from canals with a maximum concentration of 3.1 ppm (LOD of 0.25 ppm, Miles and Pfeuffer, Pesticides in Canals of South Florida, Arch. Environ. Contam. Toxicol. 32:337-345, 1997).

In the potable water studies, highly variable estimates of water concentrations have been predicted using modeling. The estimated concentrations ranged from 0.003 ppm to 0.26 ppm. These modeling estimates were not used in this assessment because of available monitoring data below.

The EPA Office of Water has also monitored for diquat at the distribution point at drinking water utilities that use surface water and ground water. Monitoring was conducted in 14 states over many years. However, data from only eight states in the years 1993-1997 were included in the report. In these eight states, the percent of combined surface water and ground water systems reporting sample exceedences of the 20 ppb MCL was 0.06 %, resulting in a 0.27 % population exceedence (Occurrence of Regulated Contaminants in Drinking Water: First Stage Occurrence and Exposure Report for Six-Year Regulatory Review, Working Draft dated May 12, 2000).

No NAWQA data for surface or ground water were available.

C. Use of Diquat as an Aquatic Herbicide

Diquat is a broad spectrum, contact herbicide that is applied in southern, mid-Atlantic, and Northern states to control some emergent and floating grass and broadleaf vegetation. Most diquat is applied in Florida where 2.5 million acres of water are managed. It kills submerged weeds with a short contact time. Diquat is the only chemical that will control water lettuce, is used to control hydrilla, and is used for duckweed control (solely nuisance infestations, not eradication). It also fills the niche that systemic broadleaf herbicides will not cover because systemic herbicides require a high concentration for an extended period of time. Use of diquat to treat smaller areas prevents application of other herbicides to larger areas. It is usually applied early in the growth season to smaller plants because it is a contact herbicide, while systemic chemicals have a larger application window (Pers. Comm. with Kurt Getsinger, U.S. Army Corp of Engineers).

It is applied 1-3 times/year depending on the plant to be treated and the climate. There is a 10-month growth period in Florida versus about 5 months in the North. If the plant is older or the growing season is longer, diquat may need to be used more than once because it is a contact herbicide. Therefore, it is usually applied once/season in the North and possibly 2-3 times/season in Florida. Diquat is applied to small areas such as boat entrances to lakes, near docks and swimming areas, boat ramps, and boat trails. Because it is a broad spectrum herbicide, it is used to prevent treatment to larger areas with a systemic herbicide (Pers. Comm. with Kurt Getsinger, U.S. Army Corp of Engineers).

South

According to the Corp of Engineers in Florida, there is a 600 ft setback distance from intakes with a 1-3 day restriction on using treated water for drinking water purposes, depending on the application rate. This is consistent with the label. Rates of 0.5 gallon/A or less require a 1-day restriction, 0.75-1 gal product/A requires a 2 day restriction, and >1 gallon require a 3-day restriction. The label also states that no more than 1/3 to ½ of a lake can be treated at once and 14 days must elapse between treatments. Posting is required at 1,600 feet downstream of treatment in flowing water and 1/4 mile from treated water in standing water bodies (
http://www.saj.usace.army.mil/conops/apc/weed_chem.htm).

In Florida, diquat (Reward) is primarily used at about 1 qt/treated acre to control water lettuce, a free-floating aquatic weed which causes problems similar to those caused by water hyacinth. It is primarily used in lakes, but not close to intakes. It is also used in faster flowing canals for hydrilla control. Spot treatment is the dominant practice because of small amounts of biomass. Mechanical harvesting is not usually an option because of cost, distance from a dumping point on land, and shallow waters. Small areas require a contact herbicide because of limited exposure time. In contrast, mechanical harvesting would be used for larger amounts of biomass, in areas where a dumping point on land is readily available, and where water is deeper. Diquat is used all year long (Pers. Comm. with Dan Thayer, South Florida Water Management District, SFWMD).

Mid-Atlantic and North

Diquat is the only product that can be used to control Egeria, which grows in NC, VA, and CA. In the north, it is used to control milfoil as spot treatments near docks and swimming areas, boat ramps, access to lake areas, and boat trails. For small areas, diquat is better than systemic herbicides because of very short contact time in small patches of weeds (Pers. Comm. with Kurt Getsinger, U.S. Army Corp of Engineers).

Michigan

Diquat is a contact herbicide that is primarily applied in lakes and ponds to control submerged vegetation in general, including Eurasian Watermilfoil (EWM). It is generally applied in water that is less than 5 feet deep or less than 300 feet from shore. The goal is to control nuisance aquatic
plants that interfere with activities such as swimming and boating access to open water. In general, Michigan prefers to use the systemic aquatic herbicide, 2,4-D, for the control of EWM because it has a narrower weed spectrum than diquat and may provide for more complete control for a longer period of time. However, diquat is often used to control EWM near wells located next to treated lakes and ponds to reduce potential drinking water exposure due to surface water and ground water interaction. Permitees are required to post the treated area with signs stating the restrictions on the use of water and when the restrictions end. Signs, including the location of the treatment area, must also be posted at all public access sites if the treatment area is larger than two acres. (Pers. Comm. with Diana Klemans, Michigan Department of Environmental Quality).
Table 4 below provides aquatic use information for diquat in 1999 and 2000:

Table 4. Aquatic Weed Control Use of Diquat in Michigan (per Diana Klemans, Michigan DEQ).

Categories	**Treatment Years**
	2000--1999
total amount of diquat used	9919 gallons--10594 gallons
average amount of diquat used per permit*	14.3 gallons--14.8 gallons
minimum amount of diquat used per permit*	0.08 gallon--0.1 gallon
maximum amount of diquat used per permit*	345 gallons--540 gallons
average permitted submergent vegetation treatment area**	15.3 acres--14.2 acres
minimum permitted submergent treatment area**	0.04 acre--0.05 acre
maximum permitted submergent treatment area**	333 acres--300 acres
# of lakes where diquat was permitted	673--642
# of ponds where diquat was permitted	303--254

* each permit may include multiple treatments of diquat over the course of the treatment year
** submergent vegetation treatment area is based upon the total area permitted for submergent vegetation control per permit

Minnesota

In Minnesota, contractors apply diquat to lakes to control submersed aquatic plants. Aquatic vegetation can impede access to lakes, especially for owners of riparian property. Any application of a herbicide to public or protected waters in Minnesota requires a permit from the Minnesota Department of Natural Resources. Treated sites are inspected in the year they are initially proposed for treatment. However, issuance of permits for site treatment in following years does not require another inspection. Eurasian watermilfoil is present in some Minnesota lakes and diquat is used to control this exotic in some cases. Nevertheless, the systemic herbicide 2,4-D is the preferred product used to manage milfoil because of selectivity and sustained control which cannot be achieved with a contact herbicide, such as diquat.

In Minnesota, applicators complete most treatments before July 4th because of heavy recreational use of water at that time. Between 1995 and 1999, 1,900 to 2,580 gallons (3,800 to 5,160 lbs ai) were applied per year in Minnesota, with an average of 4,600 lbs ai/year being used for management of aquatic plants (Control of Rooted Aquatic Vegetation, Algae, Leeches, Swimmer's Itch, 1999, Staff, Report No. 32, Minnesota Department of Natural Resources, Division of Ecological Services, dated March, 2001). Minnesota does not conduct routine or operational monitoring of herbicide concentrations in surface water from aquatic plant control (Pers. Comm. with Chip Welling of the Minnesota, Department of Natural Resources).

Summary of Memorandum

For terrestrial uses, EFED used Tier I modeling to estimate surface water concentrations and the U.S. EPA Office of Water MCLG/MCL for ground water estimates for the terrestrial uses. EFED found monitoring data for both surface and ground water for diquat, some of which was found at drinking water intakes. The aquatic use of diquat was assessed using these monitoring data (OW MCLG/MCL), information from the Corp of Engineers and different states, and potable water studies from different geographical locations in the U.S. representing diquat use areas. For aquatic uses, EFED is recommending the same acute and chronic concentrations for both surface and ground water. Although there were some exceedences of the MCL of 20 ppb in potable water, only 0.06 % of the drinking water facilities reported any sample exceedences. However, EFED is unaware of any drinking water utility being out of compliance with respect to diquat. Because of partitioning from water to sediment, EFED believes that exposure to diquat in drinking water will be generally low.

APPENDIX A. GENEEC2 Assumptions, Inputs, and Outputs for Assessed Terrestrial Crops

Exposure and Risk to Nontarget Freshwater Aquatic Animals

EFED calculates Aquatic EECs using the GENEEC2 model. The EECs are used for assessing acute and chronic risks to aquatic organisms. Acute risk assessments are performed using peak EEC values for single and multiple applications. Chronic risk assessments are performed using the 21-day EECs for invertebrates and 60-day EECs for fish. Inputs for the GENEEC2 model are provided in Table 1 of Appendix A.

Assumptions

In general, the GENEEC2 program uses basic environmental fate data and pesticide label application information to estimate of the expected EECs following treatment of 10 hectares. The model calculates the concentration (EEC) of a pesticide in a one hectare, 2-meter deep pond, taking into account the following: (1) adsorption to soil or sediment, (2) soil incorporation, (3) degradation in soil before washoff to a water body, and (4) degradation within the water body. The model also accounts for direct deposition of spray drift into the water body (assumed to be 1% and 5% of the application rate for ground and aerial applications, respectively).

Inputs Table

Table 1. GENEEC2 Input Parameters for Diquat Use on Assessed Crops

Parameter	Input*	Source/Rationale
Application rate (pounds a.i. $acre^{-1}$)		Section 3 Label
Trees /vines/small fruits/vegetables	1.0	Maximum use rate
Potatoes	0.50	
Alfalfa/Clover/Non-crop	0.50	
Number of applications		Section 3 Label
	1	Trees, vines, small fruits, vegetables, alfalfa, clover, non-crop
	2	Potatoes
Application Interval (days)		Section 3 label
	Not applicable (trees, etc)	Not applicable for trees, vines, small fruits, vegetables, alfalfa, clover, non-crop uses because of only 1 application
	14	Based on personal communication with Chuck Forsman of Syngenta

K_d	4895	Minimum non-sand value; MRID 40348601
Aerobic soil $t_{1/2}$ (days)	0 (Stable)	MRID 40973201
Is the pesticide wetted-in?	No	Section 3 label.
Depth of Incorporation (inches)	0	Section 3 label
Method of application		Section 3 label
	B	Ground (Trees , vines, small fruits, vegetables, non-crop)
	A	Aerial (Potatoes, alfalfa, and clover)
Nozzle Height	Not Applicable	Not applicable because of aerial application in potatoes, alfalfa, and clover
	B	Trees , vines, small fruits, vegetables, non-crop uses High boom (20-50 inches, EFED default), for ground application
Spray Quality	B	Aerial (fine to medium, EFED default) for potatoes, alfalfa, and clover
	A	Ground (Fine spray EFED Default) for all other uses)
Width of no-spray zone	0	Section 3 Label
Incorporation depth	0	Section 3 Label
Solubility (mg/L)	700,000	Miscible. Personal communication with Jerry Wells of Syngenta
Aerobic aquatic $t_{1/2}$ (days)	0	Stable. MRID 40927601
Hydrolysis half-life (days)	0	Stable. MRID 40418801
Photolysis half-life (days)	0	Stable. MRID 40418801

* Parameters were selected in accordance with the Proposed Interim Guidance for Input Values document, dated March 15, 2001.

Model Outputs

Trees, vines, small fruits, and vegetables as directed spray of 1 lb ai/A

```
RUN No.   1 FOR diquat          * INPUT VALUES *
  -------------------------------------------------------------------
  RATE (#/AC)   No.APPS &   SOIL  SOLUBIL   APPL TYPE  NO-SPRAY INCORP
   ONE(MULT)    INTERVAL     Kd   (PPM )    (%DRIFT)   ZONE(FT)  (IN)
```

```
------------------------------------------------------------------
1.000(  1.000)   1   1    4895.0*******   GRHIFI(  6.6)    .0    .0

 FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)
 ------------------------------------------------------------------
 METABOLIC  DAYS UNTIL  HYDROLYSIS   PHOTOLYSIS   METABOLIC  COMBINED
  (FIELD)   RAIN/RUNOFF   (POND)     (POND-EFF)    (POND)     (POND)
 ------------------------------------------------------------------
     .00        2          N/A       .00-     .00      .00       .00

 GENERIC EECs (IN MICROGRAMS/LITER (PPB))     Version 2.0 May 1, 2001
 ------------------------------------------------------------------
    PEAK      MAX 4 DAY     MAX 21 DAY    MAX 60 DAY    MAX 90 DAY
    GEEC      AVG GEEC      AVG GEEC      AVG GEEC      AVG GEEC
 ------------------------------------------------------------------
     2.32       1.34          .30           .11           .07
```

Potatoes with 2 aerial applications of 0.5 lb ai/A 14 days apart

```
 RUN No.   2 FOR diquat          ON   potatoes      * INPUT VALUES *
 ------------------------------------------------------------------
 RATE (#/AC)   No.APPS &   SOIL  SOLUBIL   APPL TYPE  NO-SPRAY INCORP
  ONE(MULT)    INTERVAL     Kd   (PPM )    (%DRIFT)   ZONE(FT)  (IN)
 ------------------------------------------------------------------
 .500(  1.000)   2  14    4895.0*******   AERL_B( 13.0)    .0    .0

 FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)
 ------------------------------------------------------------------
 METABOLIC  DAYS UNTIL  HYDROLYSIS   PHOTOLYSIS   METABOLIC  COMBINED
  (FIELD)   RAIN/RUNOFF   (POND)     (POND-EFF)    (POND)     (POND)
 ------------------------------------------------------------------
     .00        2          N/A       .00-     .00      .00       .00


 GENERIC EECs (IN MICROGRAMS/LITER (PPB))     Version 2.0 May 1, 2001
 ------------------------------------------------------------------
    PEAK      MAX 4 DAY     MAX 21 DAY    MAX 60 DAY    MAX 90 DAY
    GEEC      AVG GEEC      AVG GEEC      AVG GEEC      AVG GEEC
 ------------------------------------------------------------------
     2.40       1.41          .32           .12           .08
```

Alfalfa and clover with 1 aerial application of 0.5 lb ai/A

```
RUN No.   3 FOR diquat          ON   alfalfa an    * INPUT VALUES *
-------------------------------------------------------------------
RATE (#/AC)   No.APPS &   SOIL  SOLUBIL   APPL TYPE  NO-SPRAY INCORP
 ONE(MULT)    INTERVAL     Kd   (PPM )    (%DRIFT)   ZONE(FT)  (IN)
-------------------------------------------------------------------
.500(   .500)   1   1    4895.0*******   AERL_B( 13.0)    .0    .0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)
-------------------------------------------------------------------
METABOLIC  DAYS UNTIL  HYDROLYSIS   PHOTOLYSIS   METABOLIC  COMBINED
 (FIELD)   RAIN/RUNOFF   (POND)     (POND-EFF)    (POND)     (POND)
-------------------------------------------------------------------
    .00        2          N/A       .00-     .00      .00       .00

GENERIC EECs (IN MICROGRAMS/LITER (PPB))     Version 2.0 May 1, 2001
-------------------------------------------------------------------
    PEAK      MAX 4 DAY     MAX 21 DAY    MAX 60 DAY    MAX 90 DAY
    GEEC      AVG GEEC      AVG GEEC      AVG GEEC      AVG GEEC
-------------------------------------------------------------------
     1.20        .70           .16           .06           .04
```

Non-crop (fallow land) with 1 ground application of 0.5 lb ai/A

```
RUN No.   4 FOR diquat          ON   non-crop      * INPUT VALUES *
-------------------------------------------------------------------
RATE (#/AC)   No.APPS &   SOIL  SOLUBIL   APPL TYPE  NO-SPRAY INCORP
 ONE(MULT)    INTERVAL     Kd   (PPM )    (%DRIFT)   ZONE(FT)  (IN)
-------------------------------------------------------------------
.500(   .500)   1   1    4895.0*******   GRHIFI(  6.6)    .0    .0
```

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)	
.00	2	N/A	.00-	.00	.00	.00

GENERIC EECs (IN MICROGRAMS/LITER (PPB)) Version 2.0 May 1, 2001

PEAK GEEC	MAX 4 DAY AVG GEEC	MAX 21 DAY AVG GEEC	MAX 60 DAY AVG GEEC	MAX 90 DAY AVG GEEC
1.16	.67	.15	.05	.04

APPENDIX B. FIRST Input Table and Runs for Diquat for Assessed Terrestrial Crops

Assumptions

FIRST, like GENEEC2, is based upon the linked PRZM and EXAMS model and single event process. that was designed to provide estimated drinking water concentration (EDWC). However, it is different from GENEEC2 in several aspects. The standard field pond scenario in GENEEC2 is replaced in FIRST by an Index Reservoir which is based on Shipman City Lake in Illinois (13 acres in area, 9 feet deep, and a watershed area of 427 acres). In addition, FIRST uses Percent Cropped Area (PCA) factor which translate to reduction of area within the reservoir that is planted to modeled crop. Only those PCA values approved by OPP via the SAP (Scientific Advisory Panel) or the default values can be used as input parameters. Due to the change from the standard pond to Index Reservoir, the physical scenario as well as the treatment of spray drift is different in FIRST. Since the Index Reservoir models real world characteristics, FIRST is expected to produce more realistic estimates of pesticides in surface water that is used as a source of drinking water.

Inputs Table

Table 1. FIRST Input Parameters for Diquat use on Assessed Terrestrial Crops.

Parameter	Input*	Source/Rationale
Application rate (pounds a.i. acre^{-1})		Section 3 Label
Trees /vines/small fruits/vegetables	1.0	Maximum use rate
Potatoes	0.50	
Alfalfa/Clover/Non-crop	0.50	
Number of applications		Section 3 Label
	1	Trees, vines, small fruits, vegetables, alfalfa, clover, non-crop
	2	Potatoes
Application Interval (days)		Section 3 label
	Not applicable (trees, etc)	Not applicable for trees, vines, small fruits, vegetables, alfalfa, clover, non-crop uses because of only 1 application
	14	Based on personal communication with Chuck Forsman of Syngenta
Percent Cropped Area	0.87	Since no PCA has been determined, 0.87 is the recommended value from Guidance
K_d	4895	Minimum non-sand value; MRID 40348601
Aerobic soil $t_{1/2}$ (days)	0 (Stable)	MRID 40973201

Is the pesticide wetted-in?	No	Section 3 label.
Method of application		Section 3 label
	B	Ground (Trees , vines, small fruits, vegetables, non-crop)
	A	Aerial (Potatoes, alfalfa, and clover)
Depth of Incorporation (inches)	0	Section 3 label
Solubility (mg/L)	1,000	Miscible. MRID 40302701
Aerobic aquatic $t_{1/2}$ (days)	0	Stable. MRID 40927601
Hydrolysis half-life (days)	0	Stable. MRID 40418801
Photolysis half-life (days)	0	Stable. MRID 40418801

* Parameters were selected in accordance with the Proposed Interim Guidance for Input Values document, dated March 15, 2001.

Model Outputs

Alfalfa and clover with 1 aerial application of 0.5 lb ai/A

```
RUN No.   1 FOR diquat          ON   alfalfa an    * INPUT VALUES *
--------------------------------------------------------------------
RATE (#/AC)   No.APPS &   SOIL  SOLUBIL   APPL TYPE  %CROPPED INCORP
 ONE(MULT)    INTERVAL     Kd   (PPM )    (%DRIFT)     AREA    (IN)
--------------------------------------------------------------------
.500(   .500)   1   1    4895.0*******   AERIAL(16.0)  87.0      .0

FIELD AND RESERVOIR HALFLIFE VALUES (DAYS)
--------------------------------------------------------------------
METABOLIC  DAYS UNTIL  HYDROLYSIS   PHOTOLYSIS   METABOLIC  COMBINED
 (FIELD)  RAIN/RUNOFF  (RESERVOIR)  (RES.-EFF)   (RESER.)   (RESER.)
--------------------------------------------------------------------
    .00        2          N/A       .00-     .00      .00       .00

UNTREATED WATER CONC (MICROGRAMS/LITER (PPB))    Ver 1.0 AUG 1, 2001
--------------------------------------------------------------------
     PEAK DAY  (ACUTE)      ANNUAL AVERAGE (CHRONIC)
       CONCENTRATION            CONCENTRATION
--------------------------------------------------------------------
           6.344                   .191
```

Potatoes with 2 aerial applications of 0.5 lb ai/A 14 days apart

RUN No.   2 FOR diquat   ON   potatoes   * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL		SOIL Kd	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	%CROPPED AREA	INCORP (IN)
.500(1.000)	2	14	4895.0	*******	AERIAL(16.0)	87.0	.0

FIELD AND RESERVOIR HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (RESERVOIR)	PHOTOLYSIS (RES.-EFF)		METABOLIC (RESER.)	COMBINED (RESER.)
.00	2	N/A	.00-	.00	.00	.00

UNTREATED WATER CONC (MICROGRAMS/LITER (PPB))   Ver 1.0 AUG 1, 2001

PEAK DAY (ACUTE) CONCENTRATION	ANNUAL AVERAGE (CHRONIC) CONCENTRATION
12.687	.382

Trees, vines, small fruits, and vegetables as directed spray of 1 lb ai/A

RUN No.   3 FOR trees, vines, sm ON   diquat   * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL		SOIL Kd	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	%CROPPED AREA	INCORP (IN)
1.000(1.000)	1	1	4895.0	*******	GROUND(6.4)	87.0	.0

FIELD AND RESERVOIR HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (RESERVOIR)	PHOTOLYSIS (RES.-EFF)		METABOLIC (RESER.)	COMBINED (RESER.)
.00	2	N/A	.00-	.00	.00	.00

UNTREATED WATER CONC (MICROGRAMS/LITER (PPB))   Ver 1.0 AUG 1, 2001

```
     PEAK DAY  (ACUTE)     ANNUAL AVERAGE (CHRONIC)
      CONCENTRATION          CONCENTRATION
  ----------------------------------------------------------------
        13.214                 .349
```

Non-crop (fallow land) with 1 ground application of 0.5 lb ai/A

```
  RUN No.   4 FOR diquat          ON   non-crop      * INPUT VALUES *
  ----------------------------------------------------------------
  RATE (#/AC)   No.APPS &   SOIL  SOLUBIL   APPL TYPE  %CROPPED INCORP
   ONE(MULT)    INTERVAL     Kd   (PPM )    (%DRIFT)     AREA    (IN)
  ----------------------------------------------------------------
  .500(   .500)   1   1    4895.0*******   GROUND( 6.4)  87.0      .0

 FIELD AND RESERVOIR HALFLIFE VALUES (DAYS)
  ----------------------------------------------------------------
  METABOLIC  DAYS UNTIL  HYDROLYSIS   PHOTOLYSIS   METABOLIC  COMBINED
   (FIELD)  RAIN/RUNOFF  (RESERVOIR)  (RES.-EFF)   (RESER.)   (RESER.)
  ----------------------------------------------------------------
     .00        2         N/A      .00-     .00      .00       .00

  UNTREATED WATER CONC (MICROGRAMS/LITER (PPB))    Ver 1.0 AUG 1, 2001
  ----------------------------------------------------------------
     PEAK DAY  (ACUTE)     ANNUAL AVERAGE (CHRONIC)
      CONCENTRATION          CONCENTRATION
  ----------------------------------------------------------------
         6.607                 .174
```

APPENDIX C. SCI-GROW Input Table and Runs for Diquat for Assessed Terrestrial Crops

Assumptions

SCIGROW is a regression-based model that uses few input parameters: pesticide's organic carbon partition coefficient (Koc), aerobic soil degradation half-life, and product label application rate and frequency (Barrett, 1997). It provides a groundwater screening concentration to be used in determining the potential risk to human health from drinking water contaminated with a pesticide. The groundwater concentration is estimated based on the maximum application rates in areas where groundwater is exceptionally vulnerable to contamination. These vulnerable areas are characterized by high rainfall, rapidly permeable soil, and shallow aquifer. Since the concentrations estimated from this model are likely to be approached in only a very small percentage of drinking water sources, SCIGROW is apparently not to be applied for national or regional estimates

Inputs Table

Table 1: Input Parameters for SCI-GROW for Diquat Use on Assessed Crops.

Parameter (units)	Input Value*	Additional Comments
Application rate (pounds a.i. $acre^{-1}$)		Section 3 Label
Trees /vines/small fruits/vegetables	1.0	Maximum use rate
Potatoes	0.50	
Alfalfa/Clover/Non-crop	0.50	
Number of applications		Section 3 Label
	1	Trees, vines, small fruits, vegetables, alfalfa, clover, non-crop
	2	Potatoes
Partition Coefficient Normalized to Organic Carbon Content - K_{oc} (mL $g_{o.c.}^{-1}$ or L $kg_{o.c.}^{-1}$)	164,134	Mobility -Adsorption/Desorption study (GLN 163-1, MRID 40348601), Median value
Aerobic Soil Metabolism $t_{1/2}$ (days)	0 (Stable)	MRID 40973201

* Parameters were selected in accordance with the Proposed Interim Guidance for Input Values document, dated March 15, 2001.

Model Outputs

Alfalfa, clover, and non-crop treatment with one application of 0.5 lb ai/A

```
RUN No.   1 FOR diquat            INPUT VALUES
 --------------------------------------------------------------------
  APPL (#/AC)  APPL.  URATE    SOIL    SOIL  AEROBIC
  RATE         NO. (#/AC/YR)  KOC   METABOLISM (DAYS)
 --------------------------------------------------------------------
     .500      1       .500   164134.0        .0

 GROUND-WATER SCREENING CONCENTRATIONS IN PPB
 -------------------------------------------------------
                  .006000
 -------------------------------------------------------
A=      .000  B=      .000  C=      .000  D=      .000  RILP=      .000
F=      .000  G=      .000  URATE=      .500  GWSC=        .006000
```

Potatoes with 2 applications of 0.5 lb ai/A

```
 RUN No.   2 FOR diquat            INPUT VALUES
 --------------------------------------------------------------------
  APPL (#/AC)  APPL.  URATE    SOIL    SOIL  AEROBIC
  RATE         NO. (#/AC/YR)  KOC   METABOLISM (DAYS)
 --------------------------------------------------------------------
     .500      2      1.000   164134.0        .0

 GROUND-WATER SCREENING CONCENTRATIONS IN PPB
 -------------------------------------------------------
                  .006000
 -------------------------------------------------------
A=      .000  B=      .000  C=      .000  D=      .000  RILP=      .000
F=      .000  G=      .000  URATE=     1.000  GWSC=        .006000
```

Trees, vines, small fruits, and vegetables at 1 lb ai/A

```
 RUN No.   3 FOR diquat            INPUT VALUES
 --------------------------------------------------------------------
  APPL (#/AC)  APPL.  URATE    SOIL    SOIL  AEROBIC
  RATE         NO. (#/AC/YR)  KOC   METABOLISM (DAYS)
 --------------------------------------------------------------------
    1.000      1      1.000   164134.0        .0

 GROUND-WATER SCREENING CONCENTRATIONS IN PPB
```

.006000

A= .000 B= .000 C= .000 D= .000 RILP= .000
F= .000 G= .000 URATE= 1.000 GWSC= .006000